

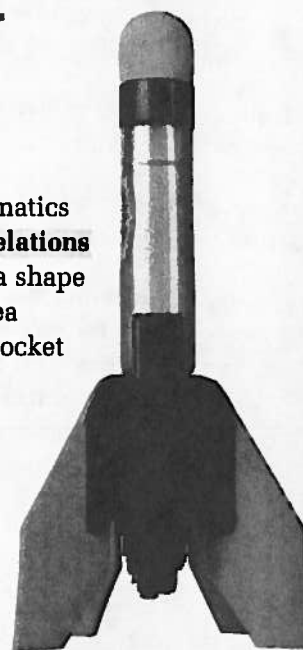
4.1

Investigate Non-Linear Relations

non-linear relation

- a relationship between two variables that does not follow a straight line when graphed

Most relations that you have studied in mathematics have been linear. However, many **non-linear relations** also exist in real life. For example, the area of a shape is measured in square units, so the graph of area versus length is non-linear. Similarly, when a rocket is launched, it follows an arch-like path.



Tools

- ruler
- grid paper

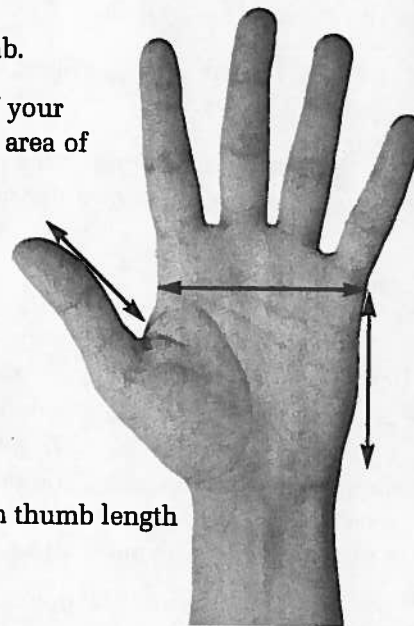
Investigate

How can you use a scatter plot to model non-linear data?

A: Relate Thumb Length and Palm Area

Work in small groups.

1. Measure the length of your thumb.
2. Measure the length and width of your palm. Calculate the approximate area of your palm.
3. Record the thumb length and palm area data for each group member.
4. Identify the independent and dependent variables.
5. Make a scatter plot of the data.
6. Describe the relationship between thumb length and palm area.
7. Draw a **curve of best fit**.



curve of best fit

- a smooth curve drawn to approximate the general path or trend in a scatter plot

8. **Reflect** Why is a curve of best fit used for these data instead of a line of best fit?
9. Use your model to predict the area of a person's palm when that person's thumb is 8.1 cm long.

B: Relate Distance and Roll Time

Work in small groups.

1. Build a ramp using two textbooks as a support.
2. Place a can 30 cm from the bottom of the ramp.
3. Release the can and time how long it takes the can to roll to the bottom. You may wish to practise starting the stopwatch at the exact moment the can is released.
4. Repeat by releasing the can from 40 cm, 50 cm, and so on.
5. Record all your data in a table. Choose your variables.
6. Identify the independent and dependent variables. Explain your choices.
7. Make a scatter plot of the results.
8. Describe the relationship between distance and roll time.
9. Draw a curve of best fit.
10. **Reflect** Why is a curve of best fit used for these data instead of a line of best fit?
11. Use your model to predict the time it would take for a can to roll down a longer ramp with the same slope from a distance of 160 cm.



Tools

- board at least 1.2 m in length
- 2 textbooks
- 1 can of soup (or other object that rolls)
- metre stick or measuring tape
- stopwatch
- grid paper

Key Concepts

- The independent variable is the one that you control before the trial begins. The dependent variable is the one that you measure during the trial. It is affected by a change in the independent variable.
- Look at the pattern of the points in a scatter plot when deciding if the relation is linear or non-linear. The points in a non-linear relation will not lie along a line, but will form a graph that is curved.

